METHOD OF TEST
DETERMINATION OF FREE MOISTURE AND ABSORPTION OF AGGREGATES

SCOPE

This method describes several procedures for determining free moisture and absorption of aggregates.

PROCEDURE A - FREE MOISTURE IN AGGREGATES USING A PYCNOMETER

A. Apparatus

1. Balance having a capacity of at least 5,000 grams accurate to 0.5 grams

2. Pycnometer - A fruit jar supplied with a gasket and conical pycnometer top. A two-quart pycnometer is used for coarse aggregates. If a two-quart pycnomter cannot be obtained, a one-quart jar may be substituted (The engineer may require 2 samples be obtained and tested in separate 1-quart pycnometers for some aggregates). The quantity of aggregate would be approximately 1000 grams for the one-quart pycnomter. A one-quart pycnometer is used for fine aggregates.

3. Thermometer - -35°C (-30°F) to 50°C (120°F) thermometer

4. Scoop

B. Field Sample

1. Obtain a field sample as prescribed in IM 301.

C. Preparation of Test Sample

1. Obtain a test sample of about 1000 grams of fine aggregate or about 2000 grams of coarse aggregate by the following method:

   Place the field sample on a clean, hard non-absorbent surface. Mix the sample thoroughly, form a miniature stockpile and obtain small increments of materials from random locations from the stockpile until the desired sample size is obtained.
   Note: The moisture test should be completed as soon as possible after obtaining the field sample to avoid moisture loss due to evaporation.

2. Weigh to the nearest 0.5 gram, a 1000 gram sample of fine aggregate, or 2000 gram sample of coarse aggregate. To avoid moisture loss due to evaporation the weighing should be done immediately after obtaining the test sample. Also avoid any excessive manipulation of the aggregate, prior to weighing, which could cause a loss of moisture.

D. Calibration of Pycnometer

1. Calibrate the pycnometer by the procedure in IM 307.

E. Test Procedure

1. The test procedure is identical to IM 307 with the exception that the test sample is wet, as received, and not in a saturated surface dry condition. This procedure is intended for determining the moisture content of aggregates for Portland Cement Concrete.

F. Calculation

1. Calculate the moisture content, based on wet sample mass (weight), to the nearest 0.1 percent as follows:

$$\text{Percent Moisture as received} = \frac{(W - W_1)Gs \times 100}{(Gs - 1)s}$$

Where:

W = Mass (Weight) in grams of the pycnometer containing a saturated-surface-dry sample of the same mass (weight) as "s" and sufficient water to fill the remaining volume of the pycnometer as determined in IM 307.

W_1 = Mass (Weight) in grams of the pycnometer containing the wet sample and sufficient amount of water to fill the remaining volume of the pycnometer.

Gs = Specific gravity of material in a saturated-surface-dry condition. (This is obtained from Method IM 307.

s = Mass (Weight) in grams of wet sample

2. The percent of moisture, based on the saturated-surface-dry mass (weight), is calculated as follows:

$$\text{Percent Moisture (SSD)} = \frac{\%\text{Moisture as received}}{100 - \%\text{Moisture as received}} \times 100$$

PROCEDURE B – FREE MOISTURE IN AGGREGATE BY MASS (WEIGHT) DIFFERENCE

This procedure is an alternate to using a pycnometer and is also intended for determining the moisture content of aggregates for Portland Cement Concrete.

A. Apparatus

1. Balance having a capacity of at least 5,000 grams and accurate to 0.5 gram

B. Preparation of Sample

1. Prepare the test sample identical to that described in Procedure A.

C. Test Procedure

1. Bring the weighed wet sample to a saturated-surface-dry condition in the manner described in Matls. IM 307 and weigh to the nearest 0.5 gram.

D. Calculation

1. Calculate the moisture content, based on wet mass (weight), to the nearest 0.1 percent as follows:

$$\text{Percent Moisture} = \frac{\text{Wt. as received - Wt. SSD}}{\text{Wt. as received}} \times 100$$

A negative result is due to absorption of the aggregate rather than free moisture.

2. The percent of moisture, based on saturated-surface-dry mass (weight), is calculated to the nearest 0.1 percent as follows:

$$\text{Percent Moisture SSD} = \frac{\text{\% Moisture as received}}{100 - \text{\% Moisture by wet mass (weight) as received}} \times 100$$

or

$$\text{Percent Moisture (SSD)} = \frac{\text{wet mass (weight) - saturated - surface - dry mass (weight)}}{\text{saturated - surface - dry mass (weight)}} \times 100$$

PROCEDURE C - WATER ABSORPTION IN AGGREGATE

This procedure is used for determining absorption of aggregates for use in asphaltic concrete as well as determining specification compliance for absorption.

A. Apparatus

1. Balance having the capacity of at least 5000 grams and accurate to 0.5 gram

2. Oven or hot plate

B. Preparation of Sample

1. Obtain a test sample of at least 1000 grams of fine aggregate and 2000 grams of coarse aggregate by following the appropriate procedure outlined in IM 307.

2. When the sample is not in a saturated condition it must be immersed in water at room temperature for a minimum of 15 hours before continuing with the test.

3. Allow the saturated sample to attain a surface-dry condition by following the procedure in IM 307.

C. Test Procedure

1. Weigh the saturated, surface-dry sample to the nearest 0.5 gram.

2. Dry the sample in the oven or on the hot plate or stove to a constant mass (weight).

3. Allow the sample to cool and weigh to the nearest 0.5 gram.

D. Calculation

1. The percent absorption, based on the oven dry mass (weight) is calculated to the nearest 0.01 percent as follows:

Percent Absorption =

$$\frac{\text{Saturated - surface - dry mass (weight) - oven dry mass (weight)}}{\text{oven dry mass (weight)}} \times 100$$